

**IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF MASSACHUSETTS**

SINGULAR COMPUTING LLC,

Plaintiff,

v.

GOOGLE LLC,

Defendant.

C.A. No. 1:19-cv-12551-FDS

Hon. F. Dennis Saylor IV

**DEFENDANT GOOGLE LLC'S REPLY IN SUPPORT OF
MOTION FOR SUMMARY JUDGMENT THAT THE ASSERTED PATENT CLAIMS
ARE PATENT INELIGIBLE**

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I. ARGUMENT

Singular can't patent math, and the asserted claims aren't patent eligible. *See Alice Corp. v. CLS Bank Int'l*, 573 U.S. 208 (2014). At step one, the claims are directed to the abstract idea of performing a mathematical operation with low precision and high dynamic range. Because the claims focus on the result and not on a solution for achieving that result via a specific technological improvement, they're directed to patent ineligible subject matter.

At step two, the Court should ask what *else* there is in the claims *beyond* the abstract idea. *See Alice*, 573 U.S. at 217. Singular instead argues that the asserted claims *as a whole* were unconventional. For example, Singular cites no evidence that mixing different precision execution units was unconventional. It cites Dr. Khatri's opinions about the purported unconventionality of *the abstract idea itself*, and his opinions repeating assertions from the specification about benefits that purportedly are due to *the invention*. But at step two "the relevant inquiry is not whether the claimed invention as a whole is unconventional or non-routine." *BSG Tech LLC v. BuySeasons, Inc.*, 899 F.3d 1281, 1290 (Fed. Cir. 2018). Dr. Khatri's opinions about the claims as a whole thus aren't relevant at step two. Singular also cites evidence that it claims shows that Google was interested in the ideas that it says that Dr. Bates presented, but that purported interest isn't evidence of anything in the claims that's significantly more than the abstract idea itself. Singular therefore fails to rebut Google's step two arguments and evidence from its opening brief.

A. ***Alice* step one: The asserted claims are directed to an abstract idea.**

At step one, courts "look at the 'focus of the claimed advance over the prior art' to determine if the claim's 'character as a whole' is directed to excluded subject matter." *Affinity Labs of Tex., LLC v. DIRECTV, LLC*, 838 F.3d 1253, 1257-58 (Fed. Cir. 2016). The specification may be "helpful in illuminating what a claim is 'directed to,'" but "reliance on the specification must

always yield to the claim language in identifying that focus.” *ChargePoint, Inc. v. SemaConnect, Inc.*, 920 F.3d 759, 766 (Fed. Cir. 2019).

1. The language of the asserted claims is focused on the abstract idea of low precision, high dynamic range mathematics.

The language of the asserted claims, with all dependencies included, begins by describing an LPHDR execution unit, thus focusing the claims on LPHDR mathematics. *See* ’273 patent at 31:62-67; ’156 patent at 29:54-49. According to the specification, prior art devices used high precision execution units, *see* ’273 patent at 3:7-5:62, but the purported invention relies on a “fundamentally different approach,” because the “embodiments of the present invention are directed to . . . us[ing] low precision high dynamic range (LPHDR) processing elements to perform computations (such as arithmetic operations).” *Id.* at 5:63-6:2; *see also id.* at 2:11-18. The specification thus confirms that LPHDR mathematics is the claimed advance over the prior art.

Low precision, high dynamic range math is an abstract idea that can be performed in the human mind. For example, approximating a tip is less precise than calculating it exactly (low precision), and can be applied to a bill of any size (high dynamic range). *See Gottschalk v. Benson*, 409 U.S. 63, 66-72 (1972) (holding ineligible claims directed to steps that “can be done mentally”); *CyberSource Corp. v. Retail Decisions, Inc.*, 654 F.3d 1366, 1371 (Fed. Cir. 2011) (inventions that “are the equivalent of human mental work” are “unpatentable abstract ideas”). Therefore, the asserted claims are directed to an abstract idea.

2. The asserted claims don’t disclose a specific solution.

As Google explained in its opening brief, the numerical parameters in the asserted claims for imprecision and dynamic range are stated in functional terms, and thus don’t limit the claims to a specific solution. *See* Google Memo. (Dkt. 469) at 9-10; *Universal Secure Registry LLC v.*

Apple Inc., 10 F.4th 1342, 1355 (Fed. Cir. 2021) (claims were abstract under *Alice* step one where they “broadly recite[d] generic steps and results” rather than a “specific solution” for generating results), *cert. denied*, 142 S. Ct. 2707 (2022). Singular doesn’t dispute that the claims place no limits on *how* the claimed device should achieve the recited imprecision or dynamic range. *See* Opp. at 12-13 (noting, and not disputing, Google’s argument that the claims don’t recite technical limits on how to design the LPHDR execution unit). Thus, neither asserted claim is directed to a technological improvement. *Affinity Labs of Tex., LLC v. Amazon.com Inc.*, 838 F.3d 1266, 1269 (Fed. Cir. 2016); *see also Elec. Power Grp., LLC v. Alstom S.A.*, 830 F.3d 1350, 1356 (Fed. Cir. 2016) (“[T]he essentially result-focused, functional character of claim language has been a frequent feature of claims held ineligible under § 101 . . .”).

Moreover, “[f]or an application of an abstract idea to satisfy step one, the claim’s focus must be something other than the abstract idea itself.” *BSG Tech*, 899 F.3d at 1287. Even with the numerical parameters, the claims are “directed to computer processors or other devices which use low precision high dynamic range (LPHDR) processing elements to perform computations (such as arithmetic operations).” ’273 patent at 5:65-6:2; *see also id.* at 2:11-18. “[A] claim is not patent eligible merely because it applies an abstract idea in a narrow way.” *BSG Tech*, 899 F.3d at 1287.

3. The “exceeds” limitation doesn’t provide a specific solution to a technological problem.

In arguing that the claims disclose a specific solution to a technological problem, Singular relies exclusively on the “exceeds” limitation. Singular’s arguments about what the claims are directed to don’t mention that the LPHDR execution units pair arithmetic circuits with memory circuits, or that claim 7 of the ’156 patent requires a computing device adapted to control them. *See* Opp. at 5-13. Singular thus doesn’t dispute that those elements don’t affect the step one

analysis. *See* Google Memo. at 10. Singular therefore implicitly concedes that only the “exceeds” limitation might in theory provide a specific solution that prevents the claims from being abstract.

The “exceeds” limitation cannot bear the weight Singular places on it. Singular argues at length that the intrinsic record shows that the claimed advance of the asserted claims over the prior art lies at least in part in the “exceeds” limitation—and specifically in the requirement that the LPHDR execution units “predominate by at least 100 units over the number of full precision execution units in the device”—and that this captures an “improvement in computer architecture.” *See* Opp. at 6, 13. But whether or not it represents the claimed advance, the “exceeds” limitation isn’t a specific solution. *See* Google Memo. at 10-11. It can’t be: It broadly encompasses wildly different technological approaches—including devices with, for example, fifteen times as many LPHDR execution units; others with no 32-bit precision execution units at all; and still others with barely more—one percent more—LPHDR execution units. *See* Opp. at 13 (conceding that Google’s statements about the “exceeds” limitation are “true”).

For that reason, as Google explained, the “exceeds” limitation at most provides a technological environment in which the abstract idea is used. Google Memo. at 11. But “limiting the use of an abstract idea to a particular technological environment” isn’t enough for patent eligibility. *See Alice*, 573 U.S. at 223 (cleaned up). At most, the “exceeds” limitation directs the skilled practitioner to apply the abstract idea in a narrower way, which cannot make the claims patent eligible. *BSG Tech*, 899 F.3d at 1287. “If a claim is directed essentially to a method of calculating, using a mathematical formula, even if the solution is for a specific purpose, the claimed method is nonstatutory” subject matter under section 101. *Parker v. Flook*, 437 U.S. 584, 595 (1978) (cleaned up).

Moreover, Singular fails to support the assertion that the “exceeds” limitation solves a technological problem. In arguing that the “exceeds” limitation is part of the claimed advance, it cites an earlier passage in its opposition, *see Opp.* at 6 (“As discussed above, at pages 1-2”), in which it claims that the specification describes “in detail” that the architecture of the purported invention enables the claimed advance. *Id.* at 2 (citing ’273 patent at 23:48-24:11). But the cited passage in the specification doesn’t mention, much less focus on, a device with more LPHDR execution units than 32-bit precision execution units. It begins by stating that embodiments of the purported invention “may be relatively small for PEs that can do arithmetic.” ’273 patent at 23:48-50. This assertedly “enables larger problems to be solved with a given amount of resource than does traditional computer designs.” *Id.* at 23:53-55. “Doing arithmetic with few resources generally means, and in the embodiments shown specifically means, that the arithmetic is done using low power.” *Id.* at 23:65-67. The cited passage concludes by asserting that “embodiments of the present invention may provide a relatively high amount of computing power per unit of cost compared to conventional computing devices.” *Id.* at 24:7-11. Nowhere does the cited passage even mention mixing LPHDR and 32-bit precision execution units, let alone explain why specifically having at least 100 more LPHDR execution units improves efficiency.¹

The specification *elsewhere* generically states that “some function” can be used to describe how the number of LPHDR execution units could exceed the number of 32-bit precision execution units, *see id.* at 28:3-8, but doesn’t assert that this is an advance over the prior art or explain how “some function” would enable the claims to solve a specific technological problem. *See id.* at 23:8-

¹ Likewise, the specification’s discussion of figure 1 states that the illustrated system has “a collection of many processing elements” of which “one or more” are “LPHDR elements” but doesn’t explain whether the system has fewer 32-bit precision execution units than LPHDR execution units. *See id.* at 8:12-28.

52; *see also Alice*, 573 U.S. at 223 (limiting the use of an abstract idea to a particular technological environment isn’t inventive). Instead, the specification provides a diverse litany of potential ways to combine LPHDR and 32-bit precision execution units—none of which matches the actual “exceeds” limitation in the claims.² This passage describes using various mixed-precision technological environments, but doesn’t assert that this wasn’t well understood, that it’s the focus of the purported invention, or that it solves any particular problem. To the contrary, the specification explains that prior graphics processors already made use of mixed-precision execution units, including “support for 16 bit floating point . . . alongside support for 32 bit floating point, and increasingly, 64 bit floating point.” ’273 patent at 5:31-33. The intrinsic evidence thus fails to support a conclusion that the focus of the claimed advance is the “exceeds” limitation of the asserted claims.

4. The asserted claims aren’t analogous to the claims in Singular’s step one cases.

Patent claims that recite a specific solution to a uniquely “technological problem” can be patent eligible. *See Alice*, 573 U.S. at 223 (discussing *Diamond v. Diehr*, 450 U.S. 175, 177, 178 (1981)); *In re TLI Commc’ns LLC Patent Litig.*, 823 F.3d 607, 613 (Fed. Cir. 2016) (explaining that a technological problem is one that is particular to the technology). Thus, in each of the step one cases that Singular cites, the Federal Circuit identified a uniquely technical problem: defective check data in *Koninklijke KPN N.V. v. Gemalto M2M GmbH*, 942 F.3d 1143, 1145 (Fed. Cir. 2019); communications latency in *Uniloc USA, Inc. v. LG Elecs. USA, Inc.* 957 F.3d 1303, 1307 (Fed. Cir. 2020); the need for unique RFID identifiers in *ADASA Inc. v. Avery Dennison Corp.*, 55

² Five examples are given, and none specifically describes a device with at least 100 more LPHDR execution units than 32-bit precision execution units. Instead, the examples state that there could be “twenty plus three times,” “fifty more than five times,” “one hundred more than five times,” “one thousand more than five times,” or “five thousand more than five times” as many LPHDR execution units. ’273 patent at 28:8-32.

F.4th 900, 904 (Fed. Cir. 2022), *cert. denied*, No. 22-822, 2023 WL 3696138 (U.S. May 30, 2023); and minimal available display space, particularly on electronic devices with small screens, in *Core Wireless Licensing S.A.R.L. v. LG Elecs., Inc.*, 880 F.3d 1356, 1359 (Fed. Cir. 2018).

In contrast, the asserted claims don’t address a uniquely technical problem. The problem that Singular argues that the claims solve is the inefficient use of transistors in prior art devices. *See* Opp. at 10, 12. Yet the claims aren’t limited to devices made with transistors; the specification states that “silicon chip fabrication technology” is “merely an example,” and that the claims also apply to “other technologies whether based on transistors or not . . .” ’273 patent at 26:17-31. Given this, the problem is nothing more than the poor use of computational resources when calculating mathematical results more precisely than necessary. *See id.* at 5:41-43 (summarizing prior “attempts to get more performance from silicon than is available in a traditional processor design”). But that isn’t a unique *technical* problem—a human approximates a tip to address the same problem, because it’s faster and easier than calculating the tip exactly. *Compare Cellspin Soft, Inc. v. FitBit, Inc.*, 927 F.3d 1306, 1316 (Fed. Cir. 2019) (rejecting “technical improvement” argument where the problem was automating a task, because “the need to perform tasks automatically is not a unique technical problem”), *with Uniloc*, 957 F.3d at 1307 (explaining the need to overcome a problem specifically arising in a technological realm).

Moreover, merely “implement[ing] a principle in some specific fashion” doesn’t make a claim patentable. *Flook*, 437 U.S. at 593. A patentable technological improvement must be a specific solution to the identified problem. *See Alice*, 573 U.S. at 223. Singular fails to identify a specific solution that’s analogous to “varying the way check data is generated by modifying the permutation applied to different data blocks” in *Koninklijke*, 942 F.3d at 1151; requiring an additional data field that “enables a primary station to simultaneously send inquiry messages and

poll parked secondary stations” in *Uniloc*, 957 F.3d at 1307-08; “a specific, hardware-based RFID serial number data structure designed to enable technological improvements to the commissioning process” in *ADASA*, 55 F.4th at 908; or specific user interface elements like those in *Core Wireless*, where a summary display had to include a limited list of data and each of the data had to be selectable to launch an appropriate application, thus enabling the selected data to be seen within the application, 880 F.3d at 1362-63. Singular instead just repeats the asserted claims in their entirety. *See Opp.* at 11 (repeating the limitations of the claims). As explained above, the limitations of the asserted claims don’t disclose a specific solution, and the “exceeds” limitation isn’t the focus of the claimed advance. Therefore, Singular’s step one cases aren’t analogous.

B. *Alice* step two: The asserted claims lack an inventive concept that’s significantly more than the abstract idea.

At step two, the Court should ask what *else* there is in the claims *beyond* the abstract idea. *See Alice*, 573 U.S. at 217. Step two thus focuses on the additional features, if any, in the claims. *Id.* at 221. If there are “additional elements”—ones that go beyond the abstract idea—then for the claims to be patent eligible those additional elements must be significantly more than the abstract idea itself, so that they transform the nature of the claims into a patentable application. *See id.*

Step two’s focus on features in addition to the abstract idea means that “the relevant inquiry is not whether the claimed invention as a whole is unconventional or non-routine.” *BSG Tech*, 899 F.3d at 1290. Thus, in *Alice* the Supreme Court

did not consider whether it was well-understood, routine, and conventional to execute the claimed intermediated settlement method on a generic computer. Instead, the Court only assessed whether *the claim limitations other than the invention’s use of the ineligible concept to which it was directed* were well-understood, routine and conventional.

899 F.3d at 1290 (emphasis added) (citing *Alice*, 573 U.S. at 224-26).

1. Singular doesn’t dispute that only three limitations are even arguably distinct from the abstract idea, or that two of them fail to transform the asserted claims into a patentable invention.

In its opening brief, Google explained that only three limitations are even arguably distinct from the abstract idea to which the asserted claims are directed. *See Google Memo.* at 13. Singular doesn’t argue otherwise. Thus, if the claims recite *significantly more* than the abstract idea, that *more* must come from those three limitations—the “execution unit” limitation, the “exceeds” limitation, and (for claim 7 of the ’156 patent) the “computing device” limitation.

Singular’s step two arguments ignore the “execution unit” and “computing device” limitations. And for the reasons stated in Google’s opening brief, neither of those limitations transforms the asserted claims into patentable subject matter. *See Google Memo.* at 13-14, 16.

2. The remaining limitation, the “exceeds” limitation, doesn’t transform the asserted claims into a patentable invention, either.

Singular’s opposition fails to dispute Google’s key points about the “exceeds” limitation. Singular doesn’t dispute that mixing different precision execution units was well known in the art, as explained both in the specification and by Dr. Gustafson. *See Google Memo.* at 15; ’273 patent at 5:31-33 (discussing mixed precision support in prior graphics processors); Gustafson Rpt. ¶ 717 (opining that “mixing different precision execution units was well-known in the art”); *see also id.* ¶¶ 187-204 (describing hardware that can implement mixed-precision systems).

Google’s undisputed evidence that mixing different precision execution units was well known in the art distinguishes the present case from *Berkheimer v. HP Inc.*, 881 F.3d 1360 (Fed. Cir. 2018). In *Berkheimer*, the Federal Circuit affirmed the district court’s ineligibility ruling as to several claims of Mr. Berkheimer’s patent. *Id.* at 1369. But as to claims 4-7, which the court held were directed to the abstract idea of, among other things, storing data, *id.* at 1366, it reached a different conclusion. Claim 4 (and claims 5-7 that depend from claim 4) required “storing a

reconciled object structure in the archive *without substantial redundancy*,” *id.* at 1370 (emphasis added), a requirement that went beyond the abstract idea of storing. The specification claimed that storing without substantial redundancy “improves system operating efficiency and reduces storage costs.” *Id.* (quoting specification). The court vacated the grant of summary judgment as to claims 4-7 because there was a genuine issue of material fact about whether elements of those claims that went beyond the abstract idea were well-understood, routine, and conventional. *Id.* In the present case, however, Singular cites no evidence that it was unconventional to mix different precision execution units.

Singular also concedes that Google’s characterization of the “exceeds” limitation in the asserted claims as encompassing a vast range of different technological approaches is correct. *See* Google Memo. at 15; Opp. at 13 (conceding that Google’s statements about the “exceeds” limitation are “true”). Singular likewise doesn’t dispute that, as Google explained, the number 100 in the “exceeds” limitation is arbitrary rather than inventive. *See* Google Memo. at 16. And “limiting the use of an abstract idea to a particular technological environment” is not enough for patent eligibility. *See Alice*, 573 U.S. at 223 (cleaned up).

Singular’s other evidence is immaterial to the step two inquiry and cannot create a factual dispute preventing summary judgment. Singular cites slides that Dr. Bates allegedly presented to Google, but points to nothing in those slides that discusses whether a device should have more (let alone at least 100 more) LPHDR execution units than 32-bit precision execution units, much less suggests that the “exceeds” limitation is unconventional. *See* Gannon Decl., Exhs. K-N. Nothing from these slides, or any other evidence that Singular cites in its opposition, *see, e.g., id.*, Exhs. E-J, O-W, addresses anything beyond the abstract idea of low precision, high dynamic range processing elements and execution units.

The remainder of Singular’s evidence, from the specification and Dr. Khatri’s expert reports, is about LPHDR mathematics *generally—that is, the abstract idea*—not about the “exceeds” limitation. Singular quotes Dr. Khatri’s opinion that the “device of claim 53 of the ’273 Patent” differs from the prior art; that “the devices claimed in the Asserted Claims” required different hardware; that “the device of claim 53” can execute more operations per clock period than conventional computers; and that the “Asserted Claims” improve on conventional computing. *See* Opp. at 14. It argues that Dr. Khatri explained that “the claimed LPHDR devices” operate in an uncommon and unconventional manner, quotes the specification’s claims about “the present invention,” and discusses purported advantages of improvements provided by use of “the claimed LPHDR devices.” *Id.* at 16, 17, 20. But step two “requires [that the Court] look with more specificity at what the claim elements add” to the abstract idea. *DIRECTV*, 838 F.3d at 1258. The cited portions of the specification and Dr. Khatri’s opinions fail to distinguish between the asserted claims and the abstract idea, and thus don’t address the inquiry that’s required at step two.

Singular therefore proffers no evidence that raises a factual dispute at step two that’s material to Google’s motion. Singular’s argument boils down to an implicit assertion that Dr. Bates’s ideas were novel and groundbreaking. But the Court need not decide whether that’s true. First, the novelty of the abstract idea itself isn’t relevant to subject matter eligibility. *Diehr*, 450 U.S. at 188-89. “[A] claim for a new abstract idea is still an abstract idea. The search for a § 101 inventive concept is thus distinct from demonstrating § 102 novelty.” *Synopsys, Inc. v. Mentor Graphics Corp.*, 839 F.3d 1138, 1151 (Fed. Cir. 2016). Second, “[g]roundbreaking, innovative, or even brilliant discovery does not by itself satisfy the § 101 inquiry.” *Ass’n for Molecular Pathology v. Myriad Genetics, Inc.*, 569 U.S. 576, 591 (2013). “[N]o matter how groundbreaking the advance,” an advance isn’t patent eligible without an inventive concept. *See SAP Am., Inc. v.*

InvestPic, LLC, 898 F.3d 1161, 1170 (Fed. Cir. 2018). So although Google disagrees about what conclusions should be drawn from the cited evidence, that dispute is immaterial.³

In short, nothing in Singular’s opposition rebuts Google’s showing that the “exceeds” limitation lacks an inventive concept that transforms the claims into a patent-eligible application. *See* Google Memo. at 14-16.⁴

3. The ordered combination of elements doesn’t transform the asserted claims into patentable subject matter.

As Google explained in its opening brief, the ordered combination of elements in the asserted claims amounts to using the idea of low precision, high dynamic range mathematics in a particular technological environment. *See* Google Memo. at 16-17. Singular doesn’t argue otherwise. Yet “limiting the use of an abstract idea to a particular technological environment” doesn’t supply an “inventive concept sufficient to transform the claimed abstract idea into a patent-eligible application.” *Alice*, 573 U.S. at 221, 223 (cleaned up). Because low precision, high dynamic range mathematics is an abstract idea, the ordered combination doesn’t transform the asserted claims into patentable subject matter.

II. CONCLUSION

The asserted claims are, as a matter of law, directed to an abstract idea, and the undisputed facts show that nothing in the asserted claims transforms them into a patentable application. Therefore, the Court should grant Google’s motion.

³ Singular’s arguments about Google’s adoption of TPUs in its data centers are irrelevant for the further reason that Google’s TPUs don’t infringe the claims. *See* Google’s Motion for Summary Judgment of Non-infringement (Dkt. 460). For present purposes, however, the Court need not resolve the issue of non-infringement, because the claims are patent ineligible regardless of whether they’re novel or groundbreaking.

⁴ Singular doesn’t dispute that conclusory opinions on the ultimate legal issue of patent eligibility cannot preclude summary judgment. *See* Google Memo. at 17 n.10; Khatri Reb. Rpt. ¶¶ 266-67; *RTR Techs., Inc. v. Helming*, 707 F.3d 84, 93 (1st Cir. 2013).

Respectfully submitted,

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CERTIFICATE OF SERVICE

I certify that this document is being filed through the Court's electronic filing system, which serves counsel for other parties who are registered participants as identified on the Notice of Electronic Filing (NEF). Any counsel for other parties who are not registered participants are being served by first class mail on the date of electronic filing.

/s/ Nathan R. Speed

Nathan R. Speed